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| 09/624,385 | 07/27/2000 | Tatsushi Katayama | 35.G2626 | 9572 |

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NEW YORK, NY 10112

EXAMINER

WANG, JIN CHENG

| ART UNIT | PAPER NUMBER |
|----------|--------------|
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2672

DATE MAILED: 09/15/2003

11

Please find below and/or attached an Office communication concerning this application or proceeding.

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Office Action Summary

Application No.

09/624,385

Applicant(s)

KATAYAMA ET AL.

Examiner

Jin-Cheng Wang

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,2,5-8,11-14,16-18 and 20-22 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1,2,5-8,11-14,16-18 and 20-22 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). ____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) ____ 6) ☐ Other: ____

DETAILED ACTION

Response to Amendment

1. The amendment filed on 06/26/2003 has been entered. Claims 1, 2, 5-7, 11-14, 16-18, 20 and 22 have been amended. Claims 3, 4, 9, 10, 15 and 19 have been canceled.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1-2, 5-8, 11-14, 16-18, 20-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Xiong et al. U.S. Patent No. 6,434,265 (hereinafter Xiong), and further in view of Shum et al. U.S. Patent No. 6,271,855 (hereinafter Shum).

4. Claim 1:

(1) Xiong teaches an image synthesis method comprising:

A placement information obtaining step of obtaining placement information about a plurality of images in which adjacent images have a common subject region (e.g., in column 4, lines 5-40, Xiong teaches a method for constructing a panorama from rectilinear images in 3D through *projective registration and calibration* including: (1) the projective registrations of overlapping images, (2) calibration and global optimization of these images, a self calibration in which 2D image planes are positioned as 3D planes in space);

A setting step of setting one mapping mode out of a plurality of mapping modes each corresponding to a different mapping surface in accordance with said obtained placement information (e.g., in column 8, lines 18-58 of Xiong, it is stated that “overlapping photographs are analyzed to determine what orientation the photographs were taken in order to establish a common ground for subsequent operations and the panorama is constructed *on a particular geometry* that will *best* facilitate the rendering of the projection of the panorama onto *a chosen viewing plane* for viewing”. The Xiong discloses some typical geometry on which panoramas are formed; In column 8, lines 18-58, Xiong further discloses that panorama is constructed on a particular geometry that will best facilitate the rendering of the projection *onto a chosen viewing plane* such as cubic, polyhedral, cylindrical and spherical geometries); and

A synthesis step of combining said plurality of images by using the mapping mode set in said setting step (e.g., in column 4, lines 5-40 of Xiong, it is stated that the composing or blending in which images are ready to be re-projected to a 3D environment map with pixels in overlap regions being composed from multiple; In column 8, lines 18-58, Xiong further teaches that overlapping photographs are analyzed to determine what orientation the photographs were taken in order to establish a common ground for subsequent operations and the panorama is constructed on a particular geometry that will best facilitate the rendering of the projection of the panorama onto a chosen viewing plane for viewing. The Xiong further discloses some typical geometry on which panoramas are formed);

A changing step, of changing the mapping mode (In column 4, lines 40-50, it is stated that “the projection module may be controlled through the user interface 230 as well, to allow a user to select what geometry will be projected onto”. Therefore, Xiong teaches a changing step

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through the user interface 230 by selecting a geometric surface out of a plurality of geometric surfaces each corresponding to a different mapping surface).

- The Examiner interprets “a placement information obtaining step of obtaining placement information about a plurality of images in which adjacent images have a common subject region” as an automatic registration and calibration step of registering the overlapping images and capturing common overlapping areas between overlapping images and minimizing the average squared pixel intensity difference with respect to certain transformation parameters.
- The Examiner interprets the mapping mode as mapping images onto a geometric surface such as a planar or a cylindrical surface (Applicant’s specification, page 1, lines 20-25). Accordingly, the Examiner interprets the setting step of setting a mapping mode as the selecting step of selecting a geometric surface. In column 8, lines 18-58, Xiong discloses that panorama is constructed on a particular geometry that will best facilitate the rendering of the projection *onto a chosen viewing plane* (a geometric surface) such as cubic, polyhedral, cylindrical and spherical geometries. In column 4, lines 40-50, it is stated that “the projection module may be controlled through the user interface 230 as well, to allow a user to select what geometry will be projected onto”. Therefore, Xiong teaches a selecting step of selecting a geometric surface out of a plurality of geometric surfaces each corresponding to a different mapping surface in accordance with the obtained placement information. As applied to the present application, Xiong fulfills the claimed limitation of a setting step of setting one mapping mode out of a plurality of

mapping modes each corresponding to a different mapping surface in accordance with said obtained placement information.

(2) However, it is not clear whether Xiong implicitly teaches the claimed limitation of “a generating step, of issuing, when an image formed by changing the mapping mode in said changing step does not comply with a predetermined condition set in accordance with the mapping mode, a warning and generating a synthesized image in accordance with the predetermined condition” in its totality (i.e., generation of a warning message).

(3) Shum implicitly teaches the claimed limitation of a generating step, of issuing, when an image formed by changing the mapping mode in said changing step does not comply with a predetermined condition set in accordance with the mapping mode, a warning and generating a synthesized image in accordance with the predetermined condition (Shum abstract; column 18, lines 55-65).

(4) It would have been obvious to one of ordinary skill in the art to have incorporated the Shum’s warning message generation step because Xiong suggests a generating step of generating a synthesized image in accordance with the predetermined condition (Xiong column 3, lines 35-55; column 17, lines 15-67; column 18, lines 1-4). Moreover, Xiong teaches in figures 2 and 3 a user interface and a global optimization that provides feedback to the computer system such as issuing warning messages on the computer monitor 218 when the pair-wise objective function is not desirable for a poor selection of the projection viewing plane (and the resulting panoramas will have imperfectly aligned images that give shadow or ghosting effects) due to a poor selection of the projection viewing plane and the resulting panoramas will have imperfectly aligned images that give shadow or ghosting effects. Xiong also points to a seamless multi-

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resolution average blending method that would result in an absent of shadow effects (column 14, lines 1-45). Xiong further teaches a human interaction being present throughout the image synthesis process to provide feedback to the computer system in all the nonlinear optimizations to let users monitor the progress of the system and allow them to intervene when necessary and therefore the claimed limitation suggests an obvious modification of Xiong because providing feedback to users is similar to issuing a message to users in a user interaction with the nonlinear optimizations when the changing step does not comply with a predetermined condition set or user-selected parameter set.

(5) One having the ordinary skill in the art would have been motivated to do this because this would have provided the user the informative message such as issuing a warning message through the user interaction when convergence to the predetermined condition setting cannot be obtained in the image synthesis (Xiong column 17, lines 15-67, column 18, lines 1-4) for non-solvable optimization problems (Shum column 18, lines 38-67).

Claim 2:

Claim 2 recites all the limitations of claim 1 and adds the limitation of “a focal length obtaining step.” Xiong teaches finding projective parameters such as 3D rotation parameters (pan, tilt roll), center of projection of images, ratio of focal lengths, and the like (column 10, lines 9-28). Xiong implicitly teaches finding the camera internal parameters vector of which the focal length is a component (column 11, lines 15-42).

Claim 5:

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The claim 5 recites all the limitations of claim 1 and adds the limitation of “a displaying step of displaying a cuttable rectangular region.” Xiong teaches how to align images more precisely by changing the coordinates for positioning an image. Xiong further teaches placing the images 1210 at selected tangents on the viewing sphere 1220 (figure 12, and column 17, lines 12-65).

5. Claim 6:

The claim 6 encompasses the same scope of invention as that of claim 1 except additional claimed limitation of “an image synthesis apparatus” and “a displaying step of displaying a cuttable rectangular region”. However, Xiong further discloses in figure 3 an apparatus for image synthesis. Xiong teaches how to align images more precisely by changing the coordinates for positioning an image. Xiong further teaches placing the images 1210 at selected tangents on the viewing sphere 1220 (figure 12, and column 17, lines 12-65).

Claim 7:

The claim 7 recites all the limitations of claim 6 and adds the limitation of “a focal length obtaining step.” The Xiong reference teaches finding projective parameters such as 3D rotation parameters (pan, tilt roll), center of projection of images, ratio of focal lengths, and the like (column 10, lines 9-28). Xiong implicitly teaches finding the camera internal parameters vector in his image synthesis apparatus of figure 3 because the focal length is a component of that vector (column 11, lines 15-42).

Claim 8:

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The claim 8 recites all the limitations of claim 6 and adds the limitation of “a changing step of changing the mapping mode.” Xiong teaches that panorama is constructed on a particular geometry that will best facilitate the rendering of the projection of the panorama onto a chosen viewing plane such as cubic, polyhedral, cylindrical and spherical geometries (column 8, lines 18-58).

6. Claim 11:

The claim 11 encompasses the same scope of invention as that of claim 1 except additional claimed limitation of a computer-readable storage medium having a program for implementing image synthesis method. However, Xiong further discloses the claimed limitation of a computer-readable storage medium having a program for implementing image synthesis method (e.g., in column 3, lines 54-57, it is stated “a program residing in system memory 220 which stores output data and other data”).

Claim 12:

The claim 12 recites all the limitations of claim 11 and adds “a focal length obtaining step.” Xiong teaches finding projective parameters such as 3D rotation parameters (pan, tilt roll), center of projection of images, ratio of focal lengths, and the like (column 10, lines 9-28). Xiong implicitly teaches finding the camera internal parameters vector of which the focal length is a component (column 11, lines 15-42).

Claim 13:

The claim 13 recites all the limitations of claim 11 and adds the limitation of “a changing step of changing the mapping mode.” Xiong teaches that panorama is constructed on a particular

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geometry that will best facilitate the rendering of the projection of the panorama onto a chosen viewing plane such as one of the cubic, polyhedral, cylindrical and spherical geometries (column 8, lines 18-58).

7. Claim 14:

The claim 14 encompasses the same scope of invention as that of claim 1 except additional claimed limitation of an image synthesis method comprising a generating step of generating coordinate-space transformation parameters. However, Xiong et al. further discloses the claimed limitation of a generating step of generating coordinate-space transformation parameters (for example, in a local pair-wise registration, the estimation of parameters in a projective matrix which represents a coordinate transformation matrix; column 11, lines 1-46).

Claim 16:

The claim 16 recites an image synthesis method comprising a reference position-setting step. The Xiong reference teaches a multi-resolution weighted average blending for perspective alignment (column 14, lines 2-45). Xiong teaches for example in column 11 setting or estimating camera orientation and the rotation matrix that is based on camera orientation.

Claim 17:

The claim 17 recites all the limitations of claim 14 and adds the limitation of “a storage step of storing a generated panoramic synthesized image.” Xiong teaches panoramic canvas which can be simply be a buffer or memory in a computer system such as memory 220 of figure 2 and onto which the blended images is copied (column 15, lines 15-28).

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8. Claim 18:

The claim 18 encompasses the same scope of invention as that of claim 1 except additional claimed limitation of an image synthesis apparatus comprising a generating means for generating coordinate-space transformation parameters and image synthesis means for combining the images. However, Xiong further discloses the claimed limitation of an image synthesis apparatus comprising a generating means for generating coordinate-space transformation parameters and image synthesis means for combining the images (e.g., a pair-wise registration module 222 and the projection function module 228. The parameters in a projective matrix are estimated which represents an image coordinate transformation matrix. The projection function module 228 constructs a panoramic scene by projecting the blended image onto any designated geometry view surface; column 4, lines 21-52, and column 11, lines 1-46).

Claim 20:

The claim 20 recites all the limitations of claim 18 and adds the limitation of “a reference position setting means.” Xiong teaches for example in column 11 setting or estimating camera orientation on which the rotation matrix is based.

Claim 21:

The claim 21 recites all the limitations of claim 18 and adds the limitation of “storage means for storing a generated panoramic synthesized image, coordinate transformation parameters and coordinate-space transformation parameters.” Xiong teaches storage means such as panoramic canvas which can be simply a buffer or memory in a computer system such as memory 220 in figure 2 and onto which the blended images is copied (column 15, lines 15-28).

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Xiong teaches that the improved projective matrix parameters (i.e., the coordinate and coordinate-space transformation parameters) can be used to generate improved estimation of camera parameters and blending may be further iterated after an initial blending (column 13, lines 53-67). Finally, Xiong teaches projective parameters, e.g., 3D rotation parameters, center of projection of images, ratio of focal lengths, and an affine transformation in constructing a two-dimensional view of the environment (column 10, lines 16-28).

9. Claim 22:

The claim 22 encompasses the same scope of invention as that of claim 1 except additional claimed limitation of a computer-readable storage medium having a program for implementing image synthesis method and a generating step of generating coordinate-space transformation parameters. However, Xiong further discloses the claimed limitation of a computer-readable storage medium having a program for implementing image synthesis method and a generating step of generating coordinate-space transformation parameters (e.g., a program residing in system memory 220 which stores output data and other data; column 3, lines 54-67. Xiong also teaches in a local pair-wise registration the estimation of parameters in a projective matrix which represents a coordinate transformation matrix; column 11, lines 1-46. Finally, the Xiong reference teaches that the improved projective matrix parameters will in turn be used to generate improved estimation of camera parameters and blending may be further iterated after an initial blending; column 13, lines 53-67).

Conclusion

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10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

a. Szeliski et al. U.S. Patent No. 6,097,854 discloses an image mosaic construction system and apparatus with patch-based alignment.

b. Kumar et al. U.S. Patent No. 5,963,664 discloses a system for generating three-dimensional mosaics from a plurality of input images.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jin-Cheng Wang whose telephone number is (703) 605-1213. The examiner can normally be reached on 8:00 AM - 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mike Razavi can be reached on (703) 305-4713. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-6606 for regular communications and (703) 308-6606 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 395-3900.

jcw
September 2, 2003



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